The Role of GIS in Health Campaign Optimization

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1.0 Background of Study

In order to support decision-making for a variety of infectious diseases and public health programs, the World Health Organization's (WHO) public health mapping and GIS program has been spearheading an international collaboration in the promotion and application of GIS since 1993 (WHO, 2000).

A computer-based tool for gathering, storing, analyzing, modifying, and displaying geographic data is called a geographical information system (GIS). Spatial and non-spatial data are integrated using GIS. It is a geospatial tool that may be used for a wide range of mapping and analytic tasks. The overall incidence of diseases that afflict many developing nations is directly impacted by having accessibility to healthcare, which is a crucial part of a comprehensive health system.

The ability of GIS to determine the geographic extent of the health facility's catchment area—that is, the area that contains the population that uses the facility—is a particularly crucial analytical tool in the context of health care planning. During local health care planning, spatial data such as patient distribution, location, and characteristics are handled. Various GIS functions and models can help with this process.

With usage across a wide range of industries, including package delivery, supply chain management, garbage collection, and home healthcare services, route optimization algorithms have revolutionized product and service delivery operations for more than 50 years.

1.1 Objectives of Study

This study is focused on optimizing the health campaign by integrating geospatial information systems for efficiency in delivery as well as minimizing cost. Therefore, outlined below are the objectives of this study:

a) To carry out location classification based on health facility availability.
b) To develop zonation mapping, hotspot mapping, contact tracing, and public health facility mapping.
c) To develop real-time dashboard for statistics and trend analysis.

2.0 Process Implementation

The WHO advises modifying the target audience and workload of Community Health Workers (CHWs) in accordance with the local geographic context and population size of the communities they serve in order to guarantee that community health programs result in equitable geographic access to care. The process implementation covers the data sources, data extraction process, and analytics solutions from the mining of the raw data.

2.1 Data Sources

1) Global Health Data Exchange: This data repository helps with relevant health related data. The following are the types of data that can be obtain from CDC Geo-Spatial Resources: administrative data, disease registry, environmental monitoring, geospatial data, etc. These data is available in CSV format but has no API access. To gain access to the data available by country, follow the following link:

https://ghdx.healthdata.org/countries

2) Data Repository from CDC Geo-Spatial Resources: Data related to public health and the environment are archived. The data may not be publicly available, but an official request may lead to the release of the data. To get access to resources, the following URL can be of utilized:

https://archive.cdc.gov/www_cdc_gov/dhdsp/maps/gisx/resources/geo-spatial-data.html

3) OpenStreetMap Data Repository: All the data on Open Street map can be found one a single repo known as the, "planet.osm". To locate the site, follow this URL: https://planet.openstreetmap.org/ . Primarily the data format is in either OSM or XML, even though there are other formats. These data include roads, points of interest, addresses, railways, land use, rivers, etc.

2.2 Data Process

The process of data extraction depends how the data is stored at the source. Most the repository discussed above don't have API or programmable access. Therefore, the data has to be extracted manually. The extracted data can be stored in a cloud repository for easy access. Each folder in the cloud repository can have restriction based on who needs access to what type of data.

2.3 Data Analytics

To carry out significant analysis that can aid us in identifying how GIS can play an important role in ensuring the optimization of health campaign, an in-depth exploration and analysis of the data using tools like ArcGIS, QGIS, or scripting tools like Python will ensure some level of success but every time the project needs an update, it will be done manually because the data source have no programmable access to their data.

| Data Lake | → | GIS Analysis Tools | → | Technical Reports |
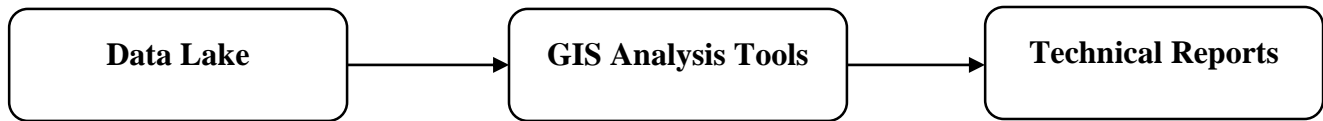
As the data are stored on a central repository, during exploration, the data can be downloaded and loaded into the GIS tool, and after analysis technical report can prepared and shared.

The analysis can capture Proximity Analysis, Average Nearest Neighbor Analysis, etc; especially for this use case.

3.0 Conclusion

To enable an effective practical approach in the application of GIS in Health Campaign, there needs for a direct hands-on implementation of the proposed methods. Data exploration and analysis needs to be target around the case study or problem being solved.

For developing nations, access to medical services is a major challenge, particularly in rural areas. Therefore, optimization of health care campaign will ensure increase in efficiency and adequate and uniform supply of resources to the health centers. The ability of a GIS to combine data from various sources is its greatest strength, even beyond its many applications in health applications. One of the main factors that leads to the usage of a GIS is the ability to visually evaluate the locations of items on the Earth's surface as opposed to attempting to decipher figures on spreadsheets.

Reference

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